TECHNICAL NOTES

U. S. DEPARTMENT OF AGRICULTURE IOWA STATE OFFICE
NATURAL RESOURCES CONSERVATION SERVICE DES MOINES, IOWA

Agronomy #16

Date: November 7, 2007

Subject: CONTOUR STRIPCROPPING PLANNING AND LAYOUT GUIDE

Contour stripcropping, one of the most effective conservation practices, is applicable to many parts of Iowa.

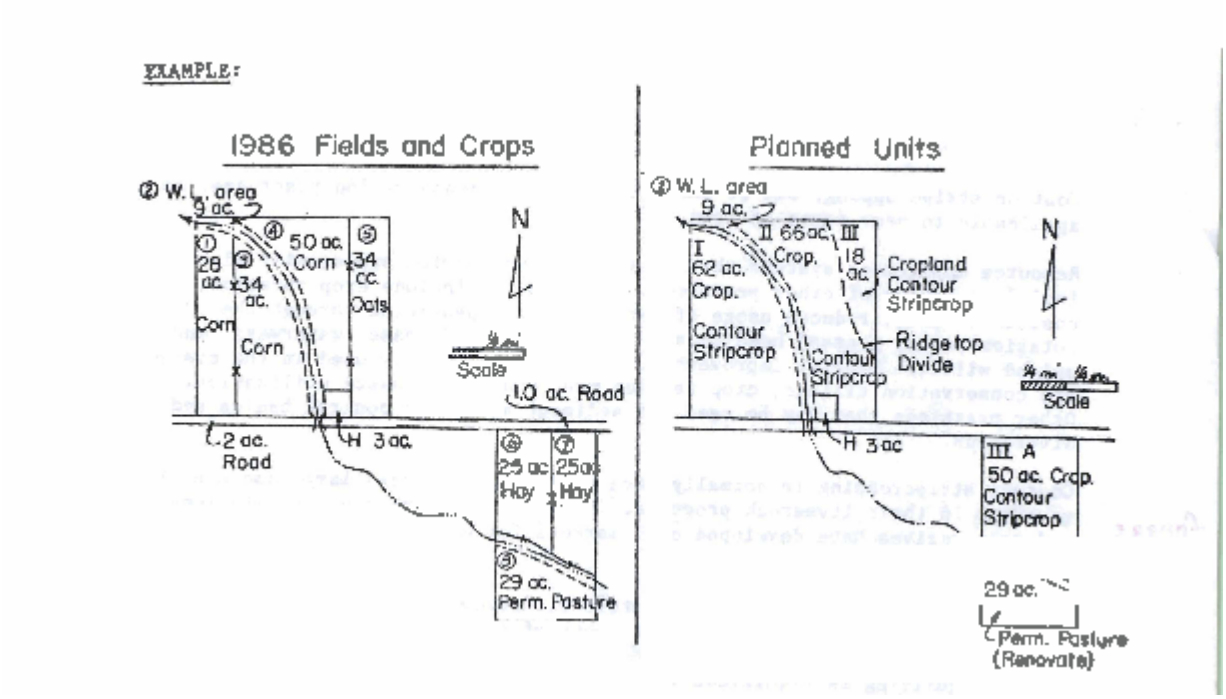
Resource management systems that include contour stripcropping will also include a number of other practices. All systems include crop rotation, contour farming, reduced usage of fertilizer and pesticide through the rotation years, grassed headlands in turnrow areas, grassed waterways, and upland wildlife habitat improvement. Practices generally used in the system are residue management, crop residue use, and waste utilization. Other practices that may be used are water and sediment control basins and diversions.

Contour stripcropping is normally used by farmers who need large amounts of forage in their livestock programs. However, hay marketing associations and cooperatives have developed cash markets for hay for other farmers using contour stripcropping.

Standards and Specifications for contour stripcropping are found in the electronic Field Office Technical Guide. The effectiveness of sheet and rill erosion control is determined using the Revised Universal Soil Loss Equation 2 (RULSE 2). Ephemeral cropland gullying is significantly reduced, but may still need control by water and sediment control basins, diversion with subsurface drainage, and/or grass waterways. Wind erosion is controlled with this practice.

The following methods of Planning and Layout of contour stripcropping have been used effectively on many Iowa farms. Farmers with a simple system, or past experience with contour stripcropping may not need, or want, detailed planning as described. (This need is determined in step five of the Nine Steps in Conservation Planning; EVALUATE: interpret and analyze data so the decision maker can understand.) Many contour strip layouts have been lost the second or third year after layout because the farmer did not understand how to develop a stripcropping crop rotation. Our job is to assist the farmer in the planning of a resource management system, either before or at the time of layout. Planning assistance is needed to be sure the farmer understands the system, to avoid chemical carryover problems, and to give the landuser the acres of crop needed for the farming enterprise, present or planned. The complete detailed planning, when needed, should be done, if possible, before layout, or no later than the first follow-up period after layout.

For those landusers who need and will use detailed planning, fields are usually combined to make larger units where possible. Fence removal may be an alternative to join adjacent fields to improve farmability. The field unit method simplifies the number of fields, and units are grouped in a manner to balance the acres per unit.



Unit #I is made by removing the fence between old fields (1) and (3) for 62 acres total. With stripcropping, the loss of wildlife habitat along the removed fencerow is made up for by the new edge created along each strip boundary, and I grassed headlands. (This is true for all units.)

Unit #II, 66 acres, is made by removing the fence between old fields (4) and (5) and making another divide on the ridge top to separate Units II and III. This ridge top divide helps balance acres in the units. Unit divisions are usually made on ridge tops, at drainage ways, and if no other way, on contour strip boundaries and farm lanes, etc.

Unit #III uses the area east of the ridge top that ran through old field (5) of 18 acres plus combining old fields (6) and (7) for 50 acres, or a total of 68 acres in Unit III.

This layout of three units gives you the number of units needed for a six year rotation of CCOMMM or CCCOMM. (CCCOMM is three years in row crop of corn, soybeans, etc., one year in small grain with new seeding, and two years of meadow forages for hay, silage, green chop, etc.)

The number of units planned is determined by the crop rotation planned with the farmer based on his crop needs:

1. One unit is needed for COM or Cox rotations.
   (x = small grain with green manure)

2. Two units for four year rotations of COMM or CCOM.

3. Three units for six year rotations of CCOMM or CCCOMM.

   Note: A direct seeding may replace the 0 year.

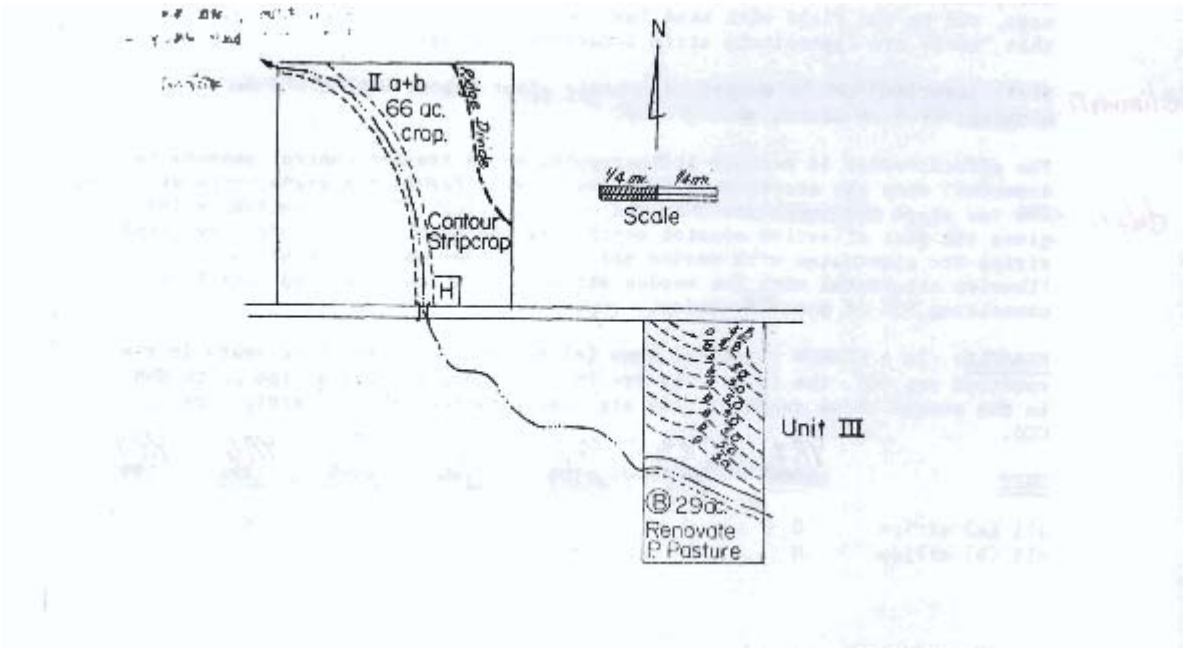
Other Rotations:

1. CCOMM rotation takes two approximately equal sized units for stripcropping and one field approximately one half the size of the units to be contour farmed with adequate conservation tillage and/or terraces as additional protection to compensate for reduced “P” values for contour strips versus contouring alone.

2. CCCOMMM rotation takes three units plus one field one half the size of the stripped units to balance the acreages in the crop rotation.

When preparing detailed planning, the unit method of planning simplifies the number of fields, and the arrangement of alternate strips within the unit are lettered in a series as (a) and (b) or (a), (b), and (c).

EXAMPLE: Contour Stripcropping Lettering System



*Unit III.

Why show planned or applied strip locations?

A. Some farmers will want to see approximately how strips will lay out before they make their decision in planning.

B. Some farmers will need acres for farm programs; cash rent; custom rates; ordering and applying nutrients, pesticides, seeds; etc.

C. Alternate strips are measured and lettered *a* and *b* in the example.

D.

a = 4.8 + 5.0 + 5.0 + 5.0 + 5.0 = 24.8 acres.

b = 4.8 + 5.0 + 5.0 + 5.0 + 4.5 = 25.2 acres

50.0 acres total in that part of Unit III mapped

*Unit II.

If planned or applied strip locations are not needed, estimate acres by assuming alternate (a) strips will be approximately one half the field, as will the (b) strips.

a = 33 acres
b = 33 acres
66 acres total in Unit II

If the farmer plans a COM rotation, strips would by lettered as (a), (b), and (c) repeating the process as you proceed from top to bottom. To estimate (a), (b), and (c) acres, divide total unit acres by three where not mapped and measured.

Strip locations are determined on planning maps by use of Arc GIS, topography maps, and in the field with hand level checks. Also, note on the plan maps that "these are approximate strip locations – actual field layout may vary."

The effectiveness of contour stripcropping as an erosion control measure is dependent upon the arrangement of close growing crops with row crops in the crop rotation. The arrangement which gives the most effective erosion control is one in which the corn (row crop) strips area alternated with meadow strips, and the small grain strips are likewise alternated with the meadow strips. This requires crop rotations containing 50% or more meadow.

EXAMPLE: In a CCOMMM rotation, when (a) strips the first three years in the rotation are CCO, the (b) strips are in MMM. When the (a) strips go to MMM in the second three years of this six year rotation, the (b) strips are in CCO.

UNIT	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
all (a) strips	C	C	O	M	M	M	C
all (b) strips	M	M	M	C	C	O	M

With three nearly even sized units planned, the crops within the rotation years are staggered to balance out acres of crop:

UNIT	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Unit I (a) strips	C	C	O	M	M	M	C
Unit I (b) strips	M	M	M	C	C	O	M
Unit II (a) strips	C	O	M	M	M	C	C
Unit II (b) strips	M	M	C	C	O	M	M
Unit III (a) strips	O	M	M	M	C	C	O
Unit III (b) strips	M	C	C	O	M	M	M

NOTE: Each year has 1/3rd row crop, 1/6th small grain, and ½ meadow in a balanced CCOMMM rotation.

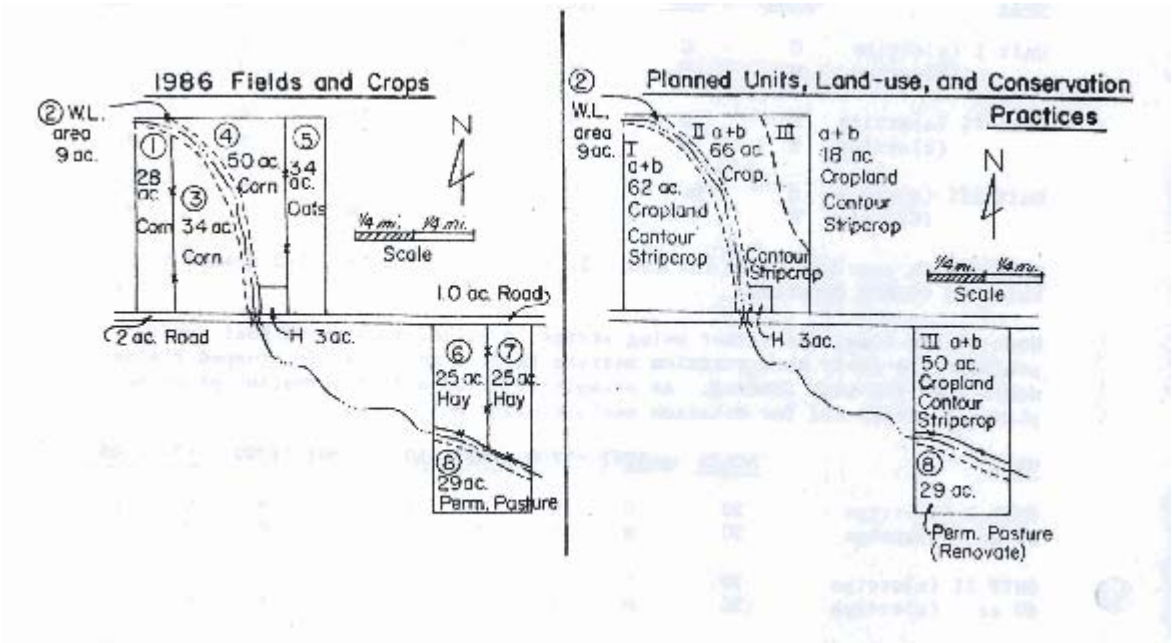
Most of the time, the farmer using strips is either a dairy or beef cow producer who needs some rotation pasture (RP). Contour strip cropped fields would need too much fencing. An example rotation and conservation practice plan for strips and for rotation pasture might be:

UNIT	ACRES	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Unit I 60 acre (a) strips	30	C	C	O	M	M	M	C	C
Unit I 60 acre (b) strips	30	M	M	M	C	C	O	M	M
Unit II 60 acre (a) strips	30	C	O	M	M	M	C	C	O
Unit II 60 acre (b) strips	30	M	M	C	C	O	M	M	M
Field (1) terrace 30 acres	30	O	RP	RP	RP	C	C	O	RP
Field (2) terrace 30 acres	30	RP	C	C	O	RP	RP	RP	C

Note: Each year has 1/3rd (60 acres) in row crop, 1/6th (30 acres) small grain, 1/3rd (60 acres) meadow (hay, silage, green chop, etc.) and 1/6th (30 acres) in rotation pasture.

The maximum grain production in a strip crop system is 50% in row crops. This is slightly less effective for erosion control, but it is a common rotation with today's larger farms and increased hay yields.

EXAMPLE: Based on the farm layout used to describe planning units and the lettering system.



Conservation Cropping System:

Units I.D.	Total Acres	Strip I.D.	Approximate Acres	Yr. 1	Yr 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6	Yr. 7	Yr. 8	Yr. 9	Yr. 10
I	62	a	31	O	M	C	C	C	O	M	M	C	C
		b	31	C	C	O	M	M	C	C	C	O	M
II	66	a	33	C	O	M	M	C	C	C	O	M	M
		b	33	O+H	C	C	C	O	M	M	C	C	C
III	68	a	34	M	M	M	C	C	C	O	M	M	C
		b	34	C	C	C	O	M	M	C	C	C	O

Crop Summary (Acres)

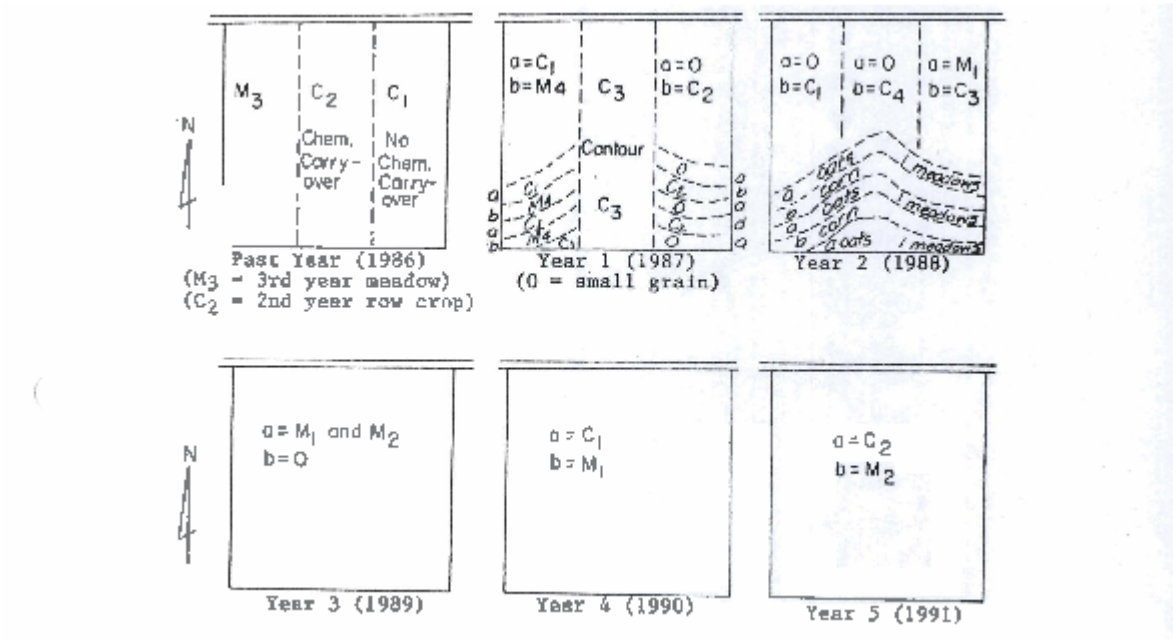
corn (C)	98	98	98	98	98	98	98	98	98	98
oats (O)	56	33	31	34	33	31	34	33	31	34
hay (M)	42	65	67	64	65	67	64	65	67	64
Total	196									

Working into crop rotations can be complicated especially where chemical carryover is a problem. This usually means delaying the strip crop layout for a year to apply other weed control methods such as less persistent chemicals, cultivation, etc.

When fields side by side are in different crops, or different age of meadow, are thrown together for form a workable unit, your alternatives are either delay strips a

year to plant the unit to one crop or have multiple crops within the strips in the first year or two.

EXAMPLE:



Color coding step maps by years on complicated plans for new cooperators can help both the farmer and the Planner determine that "what is planned will work in the field." As an example; color corn green, oats yellow, and meadow light brown. Use a color coded legend on the step maps.

Even the veteran stripcropping farmer will benefit when you sit down with them in the field after layout. Draw up a rough layout of the strips in the field and discuss how to crop them this year and in future years. Give the farmer these rough notes.

SUMMARY:

As noted, there are many possibilities for rotation, many things that complicate ease of moving into the rotation, etc. that can confuse the person applying their first strips. Also, crop failure because of weather, seed, etc.; or a change in livestock programs etc. can mean revisions in the system. To minimize confusion, conservation planning is essential for contour stripcropping.

CONTOUR STRIPCROP LAYOUT PROCEDURES:

Contour strips should be laid out to effectively control erosion and at the same time permit farming with a minimum of inconvenience. The most convenient strips are even in width throughout their entire length. To secure maximum uniformity on irregular slopes, a cable (cam-line) is used and deviations from the true contour are made. Deviations should be within allowable limits as stipulated in the Technical Guide. After the key lines are located, a cable is used for horizontal control, and a hand level for vertical control. Parallel strips are laid out to measured widths to accommodate row widths and row numbers to the equipment used to farm the strip.

Planter Size	4 – 38	6 – 30	12 - 30
Strip Width (feet)	76	90	90
	101	105	
		120	120
	127	135	150

See table for suggested widths of strips for different planter sizes.

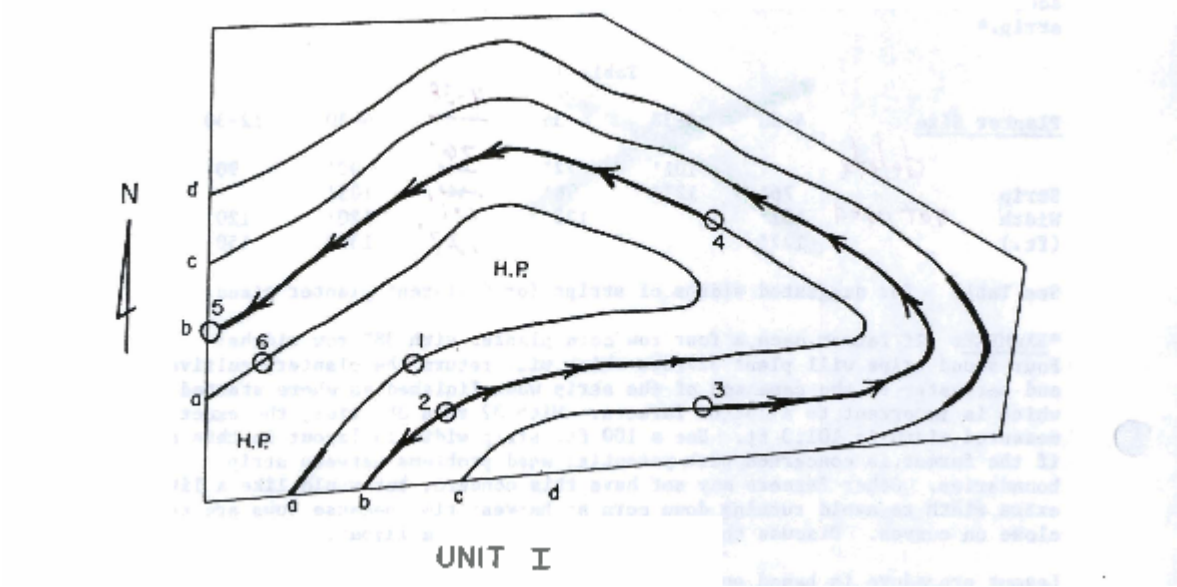
EXAMPLE: If farmer uses a four row corn planter with 38" row widths: Four round trips will plant 32 rows which will return the planter, cultivator and harvester to the same end of the strip when finished as where started which is important to a lot of farmers. With 32 rows 38" wide, the exact measured width is 101.3 ft. Use a 100 ft. strip width in layout in this case if the farmer is concerned with potential weed problems between strip boundaries. Other farmers may not have this concern, but would like a little extra width to avoid running down corn at harvest time because rows are too close on curves. Discuss this with the farmer before layout.

Layout procedure is based on the assumption that one strip can be marked above a key contour and one or more below with corrections, if any, depending on the irregularity and length of the slopes. Therefore, the true key contour will always be located as the second line below the hill top. This key contour will seldom be the same continuous line around the field, because the top of the ridge is usually not level and a contour started as the second line below the high point in the field may soon become the first line below the ridge or eventually run out on top of ridge, if continued. Whenever the key contour is one strip width from the ridge top, it is stopped and a new key is continued one or two strip widths below. The key contour, then, is a number of segments at as many different levels (or strip widths apart) as is necessary to stay below the ridge top far enough to be able to cable off one strip edge above the key segments.

The following step by step procedure can best be understood by following the numbers on the attached sketches of strip layouts. On the sketches, all heavy lines indicate true contour lines located with a level. The lines with arrows (b, c) are key contours established before starting to cable off parallel lines. Other heavy lines are corrections located with the hand level while strips were cabled off. The first step in laying out contour strips is to locate a starting point. (No. 1 on sketches).

Using a hand or other level, take a position one and a half strip widths below the highest point in the field. Position No. 1 is one and a half strip widths below the ridge high point. On nearly level horizontal ridge tops, shorten position No. 1 to one and a quarter strip widths below the ridge top. The principle, of course, is to leave a large enough top field to operate modern machinery easily but not so large as to allow excessive erosion.

The following step by step procedure will demonstrate how Unit I can be staked and marked for stripcropping.



UNIT I

1. From position No. 1, pace downhill one strip width to point No. 2. The average slope of the field should be used to determine strip width and the average will not usually occur at the edge of the field. This point will be the location for the start of the first key contour line.

2. From this point No. 2, stake key contour lines to nearest field boundary.

3. Return to point No. 2, and stake key contour line along the slope (in directions of arrows) until you reach the point where you are approximately one strip width below the ridge top.

4. Pace downhill one more strip width to point No. 3 and continue the key line staking as before. Since there is room in the field for only one more strip below this line, you will continue around the nose of the hill as indicated by arrows until you reach a point about two strip widths from the top of the ridge.

5. Pace one strip width uphill to point No. 4. This should put you about the same elevation, about one strip width from the ridge and about opposite the end of the key line started from position No. 2 over the ridge.

6. From point No. 4, a key contour line is staked all the way to the boundary of the Unit I. This line should remain approximately two strip widths from the top of the field. If not, a new key line would be started.

Sufficient key lines are now established so that all the remaining strip edges may be completed. With the aid of an assistant, a cable, and two different colored marking flags, the strips can be marked out. Alternate flag colors when marking strip boundaries. Also explain color coding and strip layout with the farmer before they start field work.

The assistant walks along the established key contour segments while the technician walks and flags the new line using the cable between them. The technician, at this end of the cable, can determine if the new line is staying on the contour. If not, necessary corrections are made with a hand level. It is important that the cable be

kept tight and always at right angles to the direction of travel of the person on the key line, at the measured length to assure farmable parallel strips.

Final Staking:

1. Start with assistant at point 5 and technician at point 6. Each one on the end of the cable of the desired strip width.

2. With a hand level, technician first stakes line to field boundary using a fence post, etc., as a sighting stake, and returns to point 6.

3. From point 6, proceed to stake new line keeping cable tight and at right angles to assistant walking the key line below. This is strip edge (a) on the sketch.

4. Stake line (a) until it approaches or points out on the ridge top (above point No. 4).

5. Assistant moves one strip width below point No.4 and technician starts at point 4 and strip edge (b) is continued around ridge top to meet key contour staked from point No. 2.

6. Move back to line (a) and finish staking through point No. 1. Since the assistant reaches the field boundary first, the last segment of line (a) is completed with a hand level as described in step No. 2.

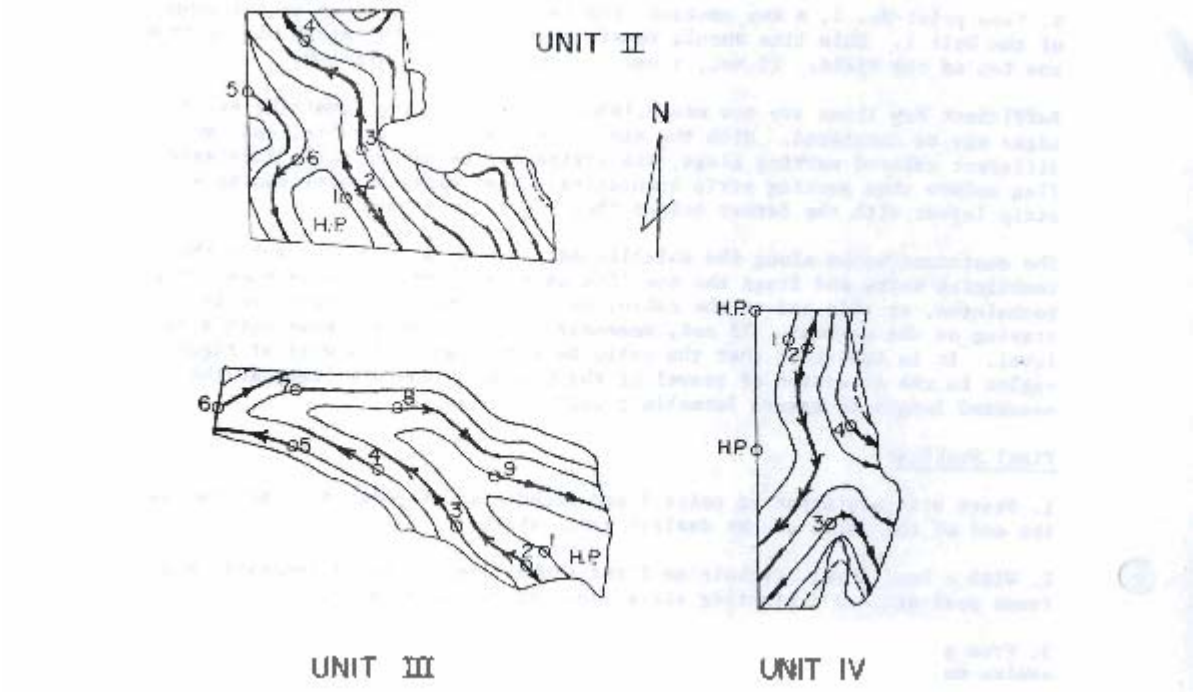
7. The assistant stays on line (b) and line (c) is staked back to point No. 3.

8. From point 3, assistant goes to point 4 and technician finishes staking line (c) to the west edge of the unit.

9. Line (d) is staked in similar manner except at the point where the line passes over the ridge of the hill. At this point the hand level is used to prevent the strip edge from deviating excessively from the true contour.

Additional Examples:

A similar layout procedure is followed in Units II, III, and IV shown with each unit having its own peculiarities.



Unit II is an odd-shaped field with considerable variation in slope.

Unit III has a ridge sloping about 4% or less with much steeper but rather uniform side slopes.

Unit IV is a hill side field with high points on farm boundary fence one and a half strip widths above starting place (1).

FACTORS THAT PROMPT LAYOUT VARIATIONS:

A number of factors may prompt variations from the layout procedure outlined above: Some fields may have a secondary high point or dominant ridge below the highest point. If this secondary high point or ridge is a more dominating feature of the field that the highest point, then the starting point should be located from the dominating feature. This will assure the first key line being located properly for the greater part of the field. Often this point, not being an important feature of the field, may be left in the top piece with the secondary highpoint or dominant ridge in which case no step up is made from the first key. Sometimes the minor highest point is so different from the main part of the field that it must be separated with a contour line that is not parallel to other lines. This results in two odd shaped top pieces rather than one, which may be necessary for adequate erosion control.

Another factor to consider is that some slopes in the field are often steeper than other slopes. Where a noticeable difference in slope is observed, one or more and in some cases all of the strip widths on the steep side should be made narrower than on the flatter side.

Another factor in making parallel lines is that in most cases any line laid parallel above a true contour line will tend to grade away from the waterways, resulting in implement marks leading runoff away from the waterways. If this occurs to any

degree, erosion may be aggravated rather that reduced. For this reason, the procedure outlined allows only one line to be laid above the true contour on the smoother top of the field. On the other hand, laying parallel lines below a true contour usually increases the grade toward the waterways. This is desirable up to a point, depending on soil erodibility factors which govern the grading of strips. These limitations are found in the Field Office Technical Guide.

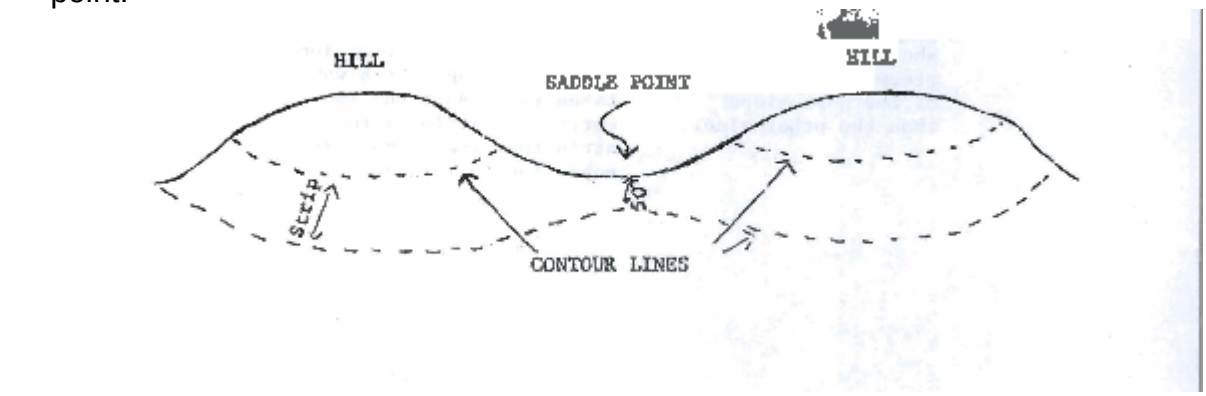
OTHER CONSIDERATIONS:

1. The strip must not be so wide as to cause more than the allowable soil loss across each strip. It is usually contemplated that the silt will drop out in the meadow strip below each strip of row crop.

2. The person on the lower end of the cable must be alert and must be able to sense rise and fall. Stops should be made frequently and checked with a hand level. If the rise or fall is excessive, return to about where the line left the contour of the land and abandon the cable temporarily, run a level contour ahead until the contour line comes back to the normal strip width and again take up measurement with the cable.

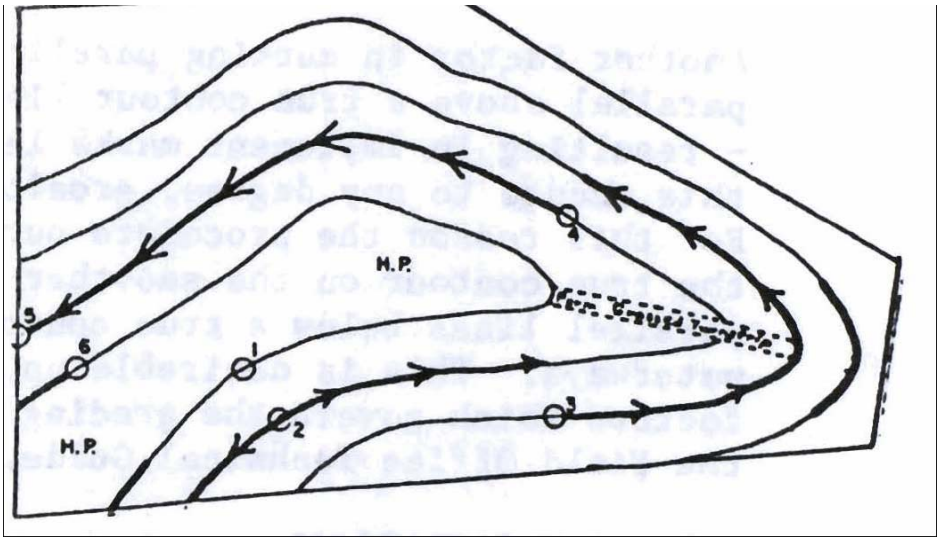
   This shift of technique from even strip to contour line will cause a bulge or narrow place in the strip but it will result in a level line from which to start planting, and from which to measure the next strip below.

3. One special case that sometimes gives trouble is a “saddle point”. This is a low ridge between two higher points in the same field. Ordinarily, the first contour is run from a point about 50 feet to one side of the low connecting ridge or saddle point.



4. Plant row crops from the top of strip as it is usually the nearest on the contour. Stub or short rows drain on the meadow strip below. Cultivators, pickers, etc. can turn on the meadow strip also. The area above the top strip may be planted in the most convenient manner.

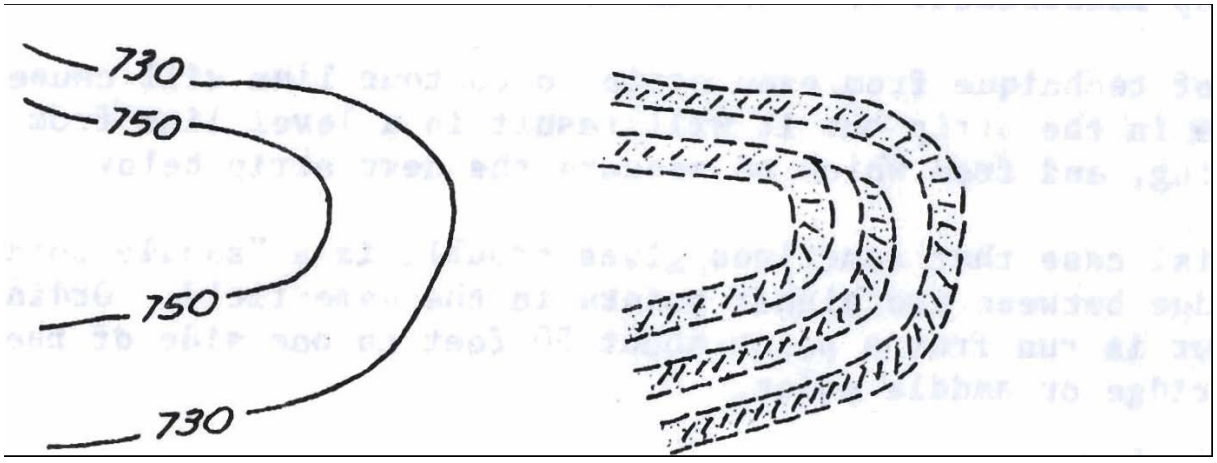
5. A grassed turnstrip down the nose of a hill is desired by some farmers who find it easier to turn on, rather than try to farm the sharp corners that result when the nose of the slope is flatter than the side slopes of the hill leading to the nose. The width of this permanent grassed turnstrip should be planned for the forage harvesting equipment used by the farmer. This can be discussed with the farmer before layout.



6. Grassed waterways should be left wide enough and extend far enough uphill to control erosion from runoff, as well as to serve as turnstrips as the contour strips change direction through drainage ways. Discuss with the farmer the correct method of planting to grassed waterways and turnstrips to avoid odd areas.

7. Nose slope corrections require two additional strips to avoid double strip widths you would get with only one or three correction strips.

EXAMPLE:



TOPOG MAP:
Where the slope is steeper on one side of the nose slope that the other side.

STRIPCROP LAYOUT CORRECTION STRIP MAP: One correction strip is wrong. It always takes two. Butt the two correction strips into a strip that goes around the nose slope.

8. On the exceptional field where slopes are nearly uniform on the entire field, the Key line can be located farther down the slope than on the average, more irregular slopes discussed earlier in this guide. By locating one-half way down the

slope or more, one Key line will work. This will give you average parallel contour curves above and below this Key line. This method can also be blended into your overall field layout, using this method on the uniform slopes and the standard layout techniques on the more irregular slopes of the field.

9. In the Planning information, it is recommended to avoid using contour strip boundaries as unit divides, if possible. This is most important where the crop rotation planned includes 50% row crops. With 50% row crop rotations, row crop strips match up against each other every four years a CCOM rotation and every 6th year with CCCOMM>

EXAMPLE: (CCOM rotation)

Unit	Strip	One	Two	Three	Four*	Five	Six	Seven	Eight*	Nine	
I	a	C1	C2	O	M	C1	C2	O	M	C1	Contour strip
	b	O	M	C1	C2	O	M	C1	C2	O	boundary as
II	a	C2	O	M	C1	C2	O	M	C1	C2	unit divide
	b	M	C1	C2	O	M	C1	C2	O	M	

* Unit I b strip C2 matched up against Unit II a strip C1 (double wide C strip)

10. Finally, establishing contouring or strips in units arranged for rectangular farming is often like trying to place round pegs in square holes. Special attention should be given to encouraging the farmer to relocate his unit boundaries parallel to the last strip, to eliminate as many irregular pieces, angling ends against fences, and short strips as possible. Attention to these and other details will result in the first class layout that will stay on the land and will long be the best possible advertisement of the product we have to sell.

/s/David W. Beck
Acting State Resource Conservationist